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## ABSTRACT

**Introduction:** Despite the falling number of edentulous patients within the UK, there is still a large demand for the provision of removable prostheses. On qualification dentists should have the knowledge and skills to provide these prostheses, but previous studies have shown that final-year dental undergraduate confidence in treating denture patients is lacking.

**Aim:** To explore undergraduate dental student confidence whilst carrying out prosthodontic treatment, and to explore their perceptions of the quality of their prosthodontic education.

**Method:** An anonymous questionnaire was distributed to all (n=203) dental undergraduates in years 3 to 5 at the University of Bristol. The questionnaire utilised a range of data collection methods including confidence interval ranked responses and qualitative measures. The data were analysed using SPSS.

**Results:** The response rate was 51%. Undergraduate perception of confidence increased throughout the years of study ( $p<0.001$ ). There was also an increase in the number of partial and complete denture cases treated as students progressed through the course ( $p<0.001$ ). Overall, students were satisfied with their prosthodontic teaching, although students thought that too much time was allocated to laboratory teaching, and that increasing their clinical experience would be most beneficial in increasing their confidence levels.

**Conclusion:** Student confidence in carrying out prosthetic treatment increased as students progressed through the course, and confidence levels would be increased further with increased clinical experience.

## INTRODUCTION

The number of patients with missing teeth is steadily declining within the UK population, with prevalence levels predicted to fall from 15 million edentate individuals in 1998 to around 6 million by 2028 (1, 2). This trend may be attributed to people receiving better education, increased ease of access to dental services and the improving attitudes towards dental health. Society has also shifted towards a more aesthetic dental appearance, probably due to media and social changes, leading individuals to request replacement of their missing teeth in order to avoid the social stigma that may arise if edentulous areas are left unfilled (3). Therefore, although the number of affected individuals is falling, demand is high and there is a continuing need for denture provision and education of dental undergraduates in order to provide these prostheses.

The advantages of removable prostheses over alternative treatments (such as fixed prostheses) include being less invasive, more affordable, suitable for development in children, reversible and they can also be modified if future tooth loss or other anatomical changes are anticipated. However, they have disadvantages including increasing plaque retention in the mouth which can lead to an increase in the risk of both periodontal disease and dental caries (4, 5). Despite the availability of alternative treatment options, including the use of osseointegrated implants, such treatments are not routinely provided under NHS funding, resulting in removable prostheses being the most affordable alternative (6).

The success of a removable prosthesis depends greatly on its design. Well-designed prostheses reduce the probability of diseases such as caries or periodontal disease developing in the abutment teeth, while also increasing the likelihood of patient tolerance (7). Therefore, dental graduates should feel confident to effectively design prostheses for their patients' health and well-being. In addition, graduates should be able to provide adequate instructions to laboratory technicians so that they can produce the desired prosthesis, as stated in The EU Medical Devices Directive (8).

All United Kingdom (UK) dental graduates are required to meet the learning outcomes laid out in the 2015 General Dental Council (GDC) document "Preparing for Practice" (9). Learning

outcome 1.14.11 states that qualifying dentists should be able to “Assess the need for, design, prescribe and provide biomechanically sound partial and complete dentures”. Dental graduates should therefore have the skills and experience necessary to provide patients with removable prostheses. Furthermore, it is essential that the evidence-based prosthetics teaching provided is sufficient to produce clinically excellent and thus confident “fully qualified beginners”. This will help to maintain patient safety and the provision of high quality care (10).

Despite the continued need to provide patients with removable prostheses, previous studies have found that the confidence of final year dental students in treating denture patients to be lacking (11, 12). A further paper outlined how differences in teaching methods could influence confidence, with students who experience clinical demonstrations exhibiting higher levels of confidence as opposed to students who only received theoretical teaching (13). Problem based learning (PBL) is a recent addition to teaching methods and since it was introduced to clinical dental teaching, research suggests that the methodology of having a student-centred, small grouped, PBL approach produced practitioners of a higher standard compared to those taught purely by traditional teaching methods (14). Additionally, it has been shown that students who have experienced clinical demonstrations before their own unsupervised treatment of patients felt more confident than those students who only receive PBL teaching (13).

The University of Bristol Dental School follows a teaching strategy whereby the main objective is to facilitate student development in furthering their clinical learning, technical competence and professionalism. It uses an integrated approach combining PBL in the form of library and critical appraisal projects alongside a more formal education. This formal education (in addition to clinical chairside teaching) comprises:

- Year-2: 3 x 45 minute lectures, 16 x 2 hr 45 minute practical sessions
- Year-3: 7 x 45 minute lectures, 21 x 2 hr 45 minute practical sessions, 12 x 30 minute tutorials
- Year-4: 9 x 45 minute lectures, 3 x 2 hr 45 minute practical sessions, 24 x 30 minute tutorials

Teaching related to partial dentures is covered during Years 2 to 4, whilst teaching related to complete dentures is covered in Year-4 only. In addition to various forms of summative assessments, students receive continuous formative feedback following their tutorials, practical sessions and clinical treatment sessions. Upon qualifying, students are expected to have completed treatment for a minimum of five patients requiring a prosthesis, with at least two needing partial and two needing complete dentures. It is hoped that students then have both the confidence and competence to undertake prosthetic treatment at a 'safe beginner' level (9).

Confidence in providing clinical care for patients is considered an important education outcome for dental undergraduates (13). Confidence can be defined as "a state of certainty in the success of a particular behavioural act" (15). This is a multifactorial concept with a broad spectrum of elements affecting student perception. Levels of integration, commitment, satisfaction, finances, prospective career, support, gender and psychology have all been identified to influence student beliefs in order to determine academic success at undergraduate university level (16). It has also been shown that the supposition of a successful performance and high self-confidence can correlate to successful performance within the course (17). A recent study investigated levels of student confidence with respect to endodontic treatment at Cardiff Dental School. This study found that the confidence of students was low and that there was scope to enhance their endodontic education (18). It is important to remember, however, that confidence does not always directly relate to competence. Overconfident students may put patients at risk by attempting procedures beyond their skill level. Although they may have the necessary skills and context, their internal perception of their ability may not give them confidence to carry out the procedure. Although increasing prosthetic clinical experience will not necessarily mean that a student will become competent, it is essential that students receive sufficient clinical exposure to prosthetic treatments, else they are unlikely to develop either competence or confidence. Irrespective of the amount of student clinical experience, students need to develop insight and an accurate self-assessment of their own competence levels and associated confidence, such that further training and clinical experience can be sought after graduation where necessary. Upon graduation, dentists need the skill to be able to target their 'weak' areas through training by using portfolios, reflection and personal development plans (19).

## **AIMS AND OBJECTIVES**

**Aim:** To investigate the confidence of undergraduate dental students at the University of Bristol when carrying out prosthetic treatment and their perception of the quality of prosthodontic education.

### **Objectives:**

- To explore the confidence levels of undergraduate dental students when carrying out prosthetic treatment
- To explore students' perception of the quality of their prosthodontic teaching
- To investigate if there is scope for prosthetic teaching to be improved

## **METHOD**

Full ethical approval from the Faculty of Medicine and Dentistry Committee for Ethics was obtained prior to the study.

An anonymous cross-sectional survey of all dental undergraduates (n=203) studying in Years 3 (n=69), 4 (n=69) and 5 (n=65) at the University of Bristol was carried out towards the end of the 2015/2016 academic year. There were no exclusion criteria. A questionnaire was developed that consisted of seven questions covering two main topics. The first covered the confidence of undergraduates when carrying out prosthodontic treatments and the second contained open questions relating to their perception of the quality of their prosthodontic teaching. The questionnaire utilised a range of data collection methods, including confidence interval responses using a Likert scale, followed by several open questions where students had the opportunity to express their opinions on specific subjects. The questionnaire was distributed via email (which respondents could print and complete) alongside hard copy handouts provided in timetabled lectures in June 2016. For consent purposes, potential participants were e-mailed 24 hours prior to the lectures with a Participant Information Sheet (PIS) so that they had time to consider whether or not they wished to participate. A consent form was not considered to be necessary as consent was implied by the participant choosing to take part in

the study. Students were allowed to withdraw at any point up until the questionnaire had been completed, and this was made clear in the PIS. To maintain the anonymity of the respondents, all completed questionnaires were collected in a 'drop-box' as students left the lecture theatre. Data from the quantitative questions were analysed using Statistical Package for Social Sciences (SPSS Version 21, IBM Corp, New York, USA). The qualitative responses from the open questions were grouped into themes for analysis.

## **RESULTS**

There was a 51% response rate with n=105 students completing the questionnaire. This comprised n=30 (28%) students from Year-3, n=49 (47%) students from Year-4 and n=26 (25%) students from Year-5.

### **Clinical experience of participants:**

A statistically significant difference ( $p<0.001$ ) was found between year groups with respect to the number of partial and complete denture cases undertaken (Figure 1). Year-3 students had very little experience of treating partial denture patients (mean 1.23) and almost no experience of complete denture patients (mean 0.03). Year-4 students had gained further experience at treating partial denture patients (mean 3.90) whilst the number of complete cases undertaken remained low (mean 1.31). Year-5 students had again acquired more partial denture experience (mean 5.73) but experience in complete cases had not increased significantly (mean 1.96) from Year-4.

### **Perception of confidence when carrying out prosthodontic treatments in a clinical setting:**

There was also a statistically significant difference ( $P<0.001$ ) in reported confidence levels between the year groups when carrying out treatment involving partial dentures, with junior students reporting lower confidence compared to senior students (Table 1). This pattern of confidence levels is also seen in relation to carrying out treatment involving complete dentures and dealing with prosthetic emergencies. Overall mean confidence levels for all students is lowest when considering complete dentures (mean=4.86) and highest when considering partial dentures (mean=6.47).

### **Perception of confidence when carrying out specific prosthodontic treatments:**

Levels of reported student confidence increased as they progressed through the course for the majority of individual prosthetic procedures (Table 2). However, there was no statistically significant difference ( $p < 0.053$ ) in reported confidence levels between the year groups when looking at the primary impression stage.

### **Perception of quality of teaching:**

The assessment of the perceived quality of prosthodontic education focussed on five different aspects: Amount of teaching time, Lectures (formal large group teaching for a whole Year group), Tutorials (small group teaching for 6 to 10 students), Laboratory Teaching (teaching of technical and practical skills using dental manikins) and Clinical Teaching (direct chairside teaching on clinic) (Figure 2). The majority of respondents (89%) replied that the amount of teaching time was 'Fair', 'Good' or 'Excellent', and an even greater number of students (93%) ranked the quality of lectures as 'Fair', 'Good' or 'Excellent'. Positive responses regarding the perceived quality of tutorials, laboratory teaching and clinical teaching were also given with 79%, 75% and 83% respectively being ranked as 'Fair', 'Good' or 'Excellent'.

Almost all ( $n=100$ ) of the completed questionnaires contained responses to the open questions, and these responses were analysed and grouped into themes. It was felt by 21% of respondents that the small group tutorials were the best part of the course and that they "liked the organisation of having the tutorials directly before the clinical sessions" which "allows the opportunity to ask questions in a more intimate setting". Other positive comments from the open questions related to the tutorials, for example "tutorials are very good in terms of the quality of staff and the range of topics covered" and "high quality tutorials". Teaching quality was given as the best aspect of the course by 18% of respondents, with responses stating that staff were "friendly", "helpful" and "people who are experts in this field". Prosthetic lectures were deemed the best part of the course by 17% of respondents, saying that they were "of a high quality and very helpful" and "interesting and well-executed lectures". The course content and depth was reported to be the best aspect of the course by 12% of respondents, and comments included "I feel like all the teaching in this subject area is excellent. I really feel that regardless of it being in a posthetics lab, lectures or tutorials, we are being taught by the best". A minority (3%) of respondents thought that the online resources and the laboratory teaching were the best aspect of the course as they provided a "thorough insight into how dentures are



made” and “how to adjust dentures”. A number of other individual responses were given, but these did not fall into any particular theme.

When looking at the negative themes, a large number (43%) of respondents thought that there was “too much time and focus spent on laboratory sessions and construction of dentures” and that they are not “clinically relevant” and “learnt many things but does not often relate to clinic”. One quarter (25%) of respondents felt that they had “insufficient” clinical time treating patients. Additionally 15% of respondents felt that lectures “did not prepare them for seeing patients” and “there is a huge gap in knowledge moving to the clinic”, that there was “too much theory and not enough practical skills taught”, and “not enough lectures”. Furthermore, 11% of respondents perceived there was a “lack of structure in tutorials” with “too varied a content”, and 6% of respondents felt that there was not enough clinical specialist supervisors on clinic.

## **DISCUSSION**

This study set out to explore the reported confidence levels of dental undergraduates when carrying out prosthodontic treatment and their perception of the quality of prosthodontic education.

It was found that overall levels of reported student confidence increased with course progression, which supports the findings of similar, previous studies (18, 19). It was also found that the number of completed denture cases increased with clinical progression, supporting an earlier study (20) which found that an increased clinical experience leads to increased student confidence.

Overall, it was found that students felt more confident when carrying out partial denture treatment, compared to complete dentures. This was not surprising as the teaching of complete dentures does not take place until Year-4, and so Year-3 students would only have had teaching and experience of partial denture construction. When students qualify, they on average, had completed more partial denture cases (mean 5.73) compared to complete dentures (mean 1.96) and again, this has a positive correlation with their reported confidence levels.

When looking at specific clinical skills (Table 2), it was again found that there was an overall trend for increasing confidence as students progressed, although it was found that final-year

students felt more confident at undertaking some procedures more than others. The procedures they felt most confident in were: taking primary impressions for partial dentures, taking secondary impressions for partial dentures and fitting partial dentures. The procedures that had the lowest levels of reported confidence by final year students were: carrying out neutral zone impressions, surveying casts and adding clasps or teeth to existing dentures. A lack of clinical experience as expressed by many participants and also a gap in knowledge between laboratory and clinical work could explain why some participants lacked confidence in these areas and again supports the findings of a previous study (20). The only procedure not to follow the trend of increasing confidence with increasing experience was that of taking primary impressions for partial denture treatment ( $p \leq 0.053$ ). This could be attributed to the fact that this procedure is similar to taking impressions for other dental procedures (such as taking impression for study models) and is therefore carried out more frequently leading to already high levels of confidence.

It is encouraging that the vast majority of students considered the quality of their prosthodontic education to be “Fair”, “Good” or “Excellent”. Overall, the quality of lectures was reported to be one of the strengths of prosthetic teaching, whilst laboratory teaching sessions were not looked upon so favourably, both in the quantitative and qualitative aspects of the study. A large number of respondents felt the prosthodontics course focused too much on the laboratory construction of dentures, time that could be spent carrying out more clinical treatments. Interestingly many respondents felt that laboratory skills were non-transferable to a clinical setting, expressing that there was a “gap in knowledge” which did not aid them in preparing sufficiently for patients. The EU Medical Devices Directive (1997) states that dental undergraduates “are required to have the skills to be able to provide sound instructions and the ability to identify faults and resolve issues in prosthesis construction” (21). It was, therefore, not surprising that when considering how the prosthetic teaching course could be improved, a large number of students responded that there should be more emphasis on clinical teaching than laboratory teaching, such that students gain more clinical experience by the time they qualify, leading to further levels of confidence. Other improvements suggested included changing the content of some lectures so as to cover more contemporary treatment techniques in greater depth and to increase the consistency in tutorial content so that all students ‘received the same knowledge’. This was surprising as tutorial consistency is currently achieved by way of each tutorial having a pre-prepared handout, which summarises the points

for discussion, and the tutorials being led by only a limited number of clinicians. Despite this, it is inevitable that some students will receive a slightly differing experience to their colleagues. However, the majority of students already highlighted tutorials to be the area within the prosthodontic course which excels, stating that the tutorials are of a high standard and are very helpful to undergraduate learning.

Overall, this study has met its aims and objectives, but it does have some limitations. The response rate of 51% means that there may be some selection bias in respondents, and as 47% of respondents were from Year-4, there may be some skewing of the results. The responses may be less representative of students within Years 3 to 5. The low response rate from Year-5 students may be attributed to the fact that they were all on study leave at the time of questionnaire distribution, and so they were only invited by e-mail to participate, unlike the Year-3 and 4 students who were also invited to participate following one of their timetabled lectures. In hindsight, better timing of the study would have been preferable so as to increase the response rate from Year-5 students. There was a poor attendance at the lecture chosen to distribute the questionnaires to the Year-3 students, again resulting in a lower response rate from this year group. Another factor that may have affected response rate was that students may have felt hesitant to respond if they felt that they had negative comments to make that could be construed as criticism of their teaching, despite being reassured that all responses were anonymous. If further studies are undertaken, the methodology for questionnaire distribution should be improved, so as to hopefully achieve a higher response rate. However, it has been suggested that only a 60% response rate could be expected for this type of survey (22) and a response rate of less than 60% can still be satisfactory (23).

Other limitations of this study are that some of the questions asked were open to variable interpretation, resulting in several anomalous answers. This may have been overcome by the piloting of the questionnaire prior to its distribution. In addition, students' perceptions of confidence levels are subjective, and there was likely individual variation in interpretation as to where on the 10 point scale the cut off was for being 'confident' and 'not confident'. Furthermore, the question asking students to rank aspects of their teaching would have benefitted from descriptors of the levels to help remove subjectivity.

The results of this study are specific to one university. Each university will have its own course structure and methods of teaching, thus students will have differing clinical and educational

experiences, and so it would be incorrect to assume that these results are necessarily generalisable.

Despite these limitations, this study provides a contemporary benchmark of the confidence levels of dental undergraduates when undertaking prosthetic treatment.. The school is currently undertaking a major curriculum review and the results of this study may help to steer planning of the future undergraduate curriculum. The results of this study would suggest that consideration should be given to:

- Making the technical exercises more clinically relevant
- Increasing the overall amount of prosthetic clinical experience
- Increasing teaching on specific topics including surveying casts, relining dentures, additions to dentures and neutral zone impressions

## CONCLUSIONS

This study found that student levels of perceived confidence increased as they progressed through the course and gained further clinical experience. There were higher levels of confidence reported for partial denture construction than for complete denture construction. Overall, students were satisfied with the quality of their prosthodontic education, and suggestions were made as to how their teaching could be further improved.

**Conflicts of Interest:** All authors declare no conflicts of interest.

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**Table 1:** Mean undergraduate confidence levels (and standard deviation) where '1' = 'not at all confident' and '10' = 'extremely confident'

Questions in relation to confidence	Year-3	Year-4	Year-5	Significance
How confident do you feel when carrying out partial denture treatment?	5.07 (1.58)	6.88 (1.50)	7.42 (1.20)	<0.001
How confident do you feel when carrying out complete denture treatment?	2.47 (1.75)	5.57 (1.95)	6.27 (1.90)	<0.001
How confident do you feel when carrying out emergency denture treatment?	3.73 (1.57)	6.57 (1.84)	7.35 (1.95)	<0.001

**Table 2:** Mean undergraduate confidence levels (and standard deviation) for individual prosthetic procedures where '1' = 'not at all confident' and '10' = 'extremely confident'

Questions in relation to confidence to specific treatments	Year-3	Year-4	Year-5	p-value
Taking primary impressions for a partial denture	7.53 (1.65)	8.08 (1.55)	8.54 (1.33)	0.053
Surveying casts for a partial denture	4.37 (2.29)	4.65 (2.26)	6.38 (2.19)	0.002
Designing a partial denture	5.00 (2.01)	5.35 (2.16)	7.35 (1.32)	<0.001
Cutting rest seats and guide planes	3.10 (1.90)	5.69 (2.21)	7.35 (2.11)	<0.001
Border moulding a special tray with greenstick	5.63 (1.77)	7.24 (1.36)	8.08 (1.44)	<0.001
Taking secondary impressions for a partial denture	6.67 (1.86)	7.29 (1.52)	8.38 (1.20)	<0.001
Recording jaw relationships for a partial denture	4.77 (2.25)	6.55 (1.52)	7.19 (1.78)	<0.001
Assessing the fit of a partial denture framework	4.10 (2.00)	6.45 (1.38)	7.15 (1.99)	<0.001
Carrying out the try-in stage of a partial denture	5.13 (2.51)	7.10 (1.08)	7.65 (1.69)	<0.001
Carrying out the fit stage of a partial denture	5.20 (2.41)	7.47 (1.35)	8.27 (1.40)	<0.001
Taking primary impressions for a complete dentures	4.70 (2.95)	7.00 (1.72)	7.62 (1.79)	<0.001
Taking secondary impressions for a complete dentures	4.33 (3.05)	6.76 (1.80)	7.46 (1.50)	<0.001
Recording the jaw relationships for complete dentures	3.23 (2.40)	5.45 (1.95)	6.36 (2.17)	<0.001
Assessing the freeway space	3.43 (2.09)	5.67 (1.96)	7.12 (2.33)	<0.001
Selecting the shade and mould for complete dentures	5.97 (2.67)	7.59 (1.60)	7.92 (1.41)	<0.001
Carrying out the try-in stage for complete dentures	3.33 (2.44)	6.44 (1.57)	7.48 (1.82)	<0.001
Carrying out the fit stage for complete dentures	3.60 (2.54)	7.22 (1.53)	7.52 (2.04)	<0.001
Taking duplication impressions for complete dentures	3.33 (2.44)	5.47 (2.16)	7.88 (2.10)	<0.001
Taking reline impressions	2.50 (1.57)	4.57 (2.17)	6.64 (2.48)	<0.001
Adding a tooth or clasp to an existing denture	3.20 (1.62)	4.92 (2.17)	6.00 (1.97)	<0.001
Carrying out a 'neutral zone' impression	1.77 (1.19)	3.61 (2.32)	4.64 (2.28)	<0.001
Treating a patient returning with painful dentures	3.63 (1.67)	6.08 (2.10)	7.40 (2.10)	<0.001